

### ABSTRACT OF THE DISCLOSURE

An optical sensor includes photoemitter and photodetector elements at multiple spacings ( $d_1$  ,  $d_2$ ) for the purpose of measuring the bulk absorptivity ( $\alpha$ ) of an area immediately surrounding and including a hemodialysis access site, and the absorptivity ( $\alpha_o$ ) of the tissue itself. At least one photoemitter element and at least one photodetector element are provided, the total number of photoemitter and photodetector elements being at least three. The photoemitter and photodetector elements are collinear and alternately arranged, thereby allowing the direct transcutaneous determination of vascular access blood flow.